Alaska Fisheries Data Series Number 2001-2

Abundance and Run Timing of Adult Chum Salmon, and Steelhead Kelt Emigration in the Sturgeon River, Kodiak, Alaska, 1999

Mary A. Price

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MARY A. PRICE

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Abstract.—From May 26 to July 24 1999, a flexible picket weir was installed in the Sturgeon River, Kodiak Island. A total of 71,610 chum salmon *Oncorhynchus keta* passed through the weir from May 28 to July 24. The run exhibited three pulses with the peaks occurring on June 14 (*N*=4,273), June 27 (*N*=3,582), and July 14 (*N*=5,320). A total of 476 steelhead *O. mykiss* passed downstream through the weir from May 26 to July 13, with the peak occurring on June 29 (*N*=86). Water temperatures ranged from 4 to 14 °C and averaged 9 °C.

Introduction

The Sturgeon River provides important spawning and rearing habitat for chum *Oncorhynchus keta*, pink *O. gorbuscha*, and coho *O. kisutch* salmon, steelhead *O. mykiss*, and Dolly Varden *Salvelinus malma*. In the Kodiak Archipelago, Sturgeon River chum salmon exhibit unique run timing, entering the lagoon in late May to mid-June compared to other Kodiak chum salmon stocks which enter the rivers in mid-to-late July (Chatto 1998). These early chum salmon provide a valuable protein food source for large concentrations of brown bear and bald eagles that congregate within the river corridor. The Sturgeon River was identified as 1 of 10 special values for the Kodiak National Wildlife Refuge (Refuge) in its Comprehensive Conservation Plan (U.S. Fish and Wildlife Service 1987).

Previous fisheries data on the Sturgeon River consist of annual aerial escapement index surveys for chum salmon in the river and lagoon conducted by the Alaska Department of Fish and Game (Department) and the Refuge (Appendix 1); a chum salmon spawning habitat study by the Refuge (Chatto 1998); and data gathered from the first year of weir operation, 1998 (Faustini 1999). The Department indexed escapement goal for chum salmon ranges from 25,000 to 75,000 (Kevin Brennan, Alaska Department of Fish and Game, personal communication), which was recently reduced from a historic range of 50,000 to 150,000 (Brennan et al. 1997). The Refuge escapement goal recommendation is 27,000 to 42,600 (Chatto 1998).

Prior to 1999, Sturgeon River chum salmon escapement was declining, as indicated by the 10-year averages of the aerial escapement index survey data (Figure 1, Appendix 1). Between 1993 and 1999, Sturgeon River chum salmon have met the minimum escapement goal three times (1994, 1995, and 1999), and the estimated escapements for 1996-1998

have been the lowest on record. Aerial surveys in general are highly variable and are only an index of relative strength of salmon runs. Aerial surveys of the Sturgeon River are complicated since estimates are a composite of both in-river and lagoon counts. During some years (1989, 1993, 1994), salmon observed in the lagoon were not seen in subsequent in-river surveys (Chatto 1998).

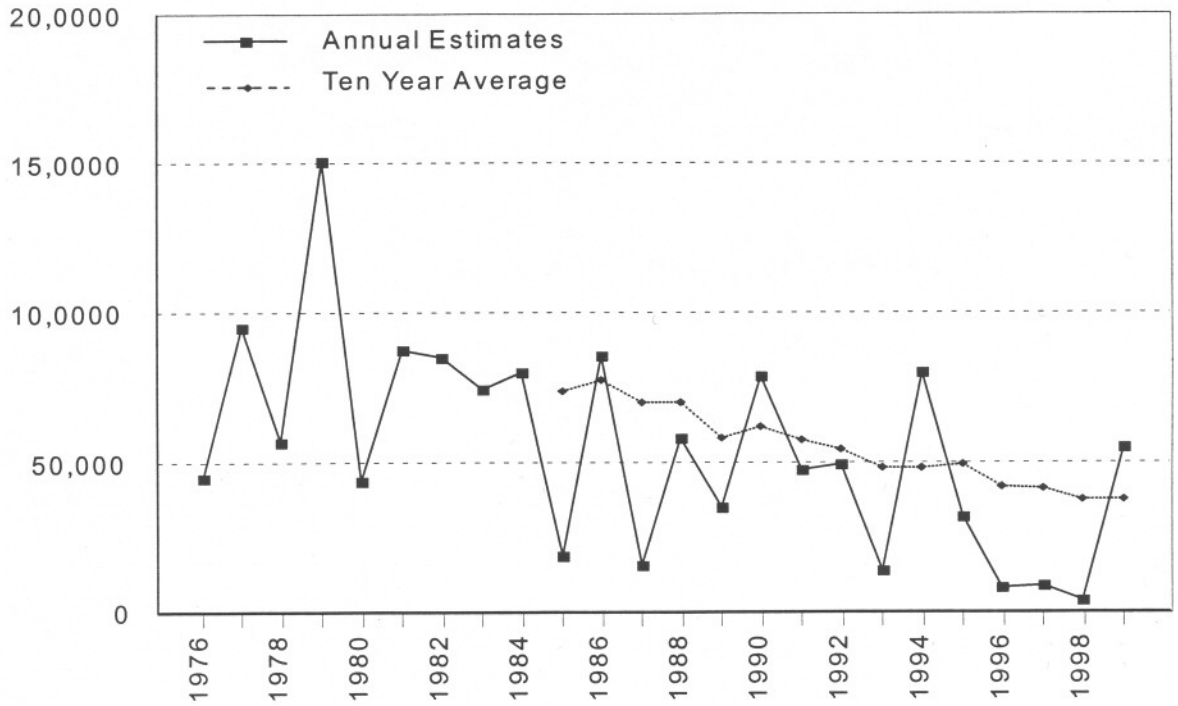

FIGURE 1.—Peak aerial index escapement counts and the ten year average of the annual index escapement counts for the Sturgeon River, Kodiak, Alaska.

Sport anglers fish for Sturgeon River steelhead annually in September and October. The status of this steelhead population is unknown.

The decline of Sturgeon River chum salmon, the variability of aerial surveys, and the lack of steelhead status and trends data is of concern to the Refuge. Not only are these populations important components of the ecosystem, but Section 303 (5)(b) of the Alaska National Interest Lands Conservation Act (ANILCA) specifically mandates that the Refuge shall be managed to conserve the natural diversity of fish and wildlife populations and their habitats. Reliable data on salmon stocks originating on the Refuge is required to ensure compliance with ANILCA. To that end, the U.S. Fish and Wildlife Service operated a fish weir in 1998 and 1999 to provide more accurate escapement data than has been available. The specific goals are to: (1) enumerate adult chum salmon; (2) describe timing of chum salmon returns; and (3) enumerate emigrating adult steelhead.

Study Area

The 170 km^2 Sturgeon River drainage is located on the west side of Kodiak Island. The mainstem Sturgeon River flows from its headwaters in the Refuge for approximately 28.3 km to Sturgeon Lagoon. The south fork tributary of the Sturgeon River flows for approximately 8.2 km prior to joining the mainstem 12.8 km above the lagoon (Figure 2). The lower 21 km of the mainstem and 2.6 km of the south fork are located on lands administered by Koniag Inc.

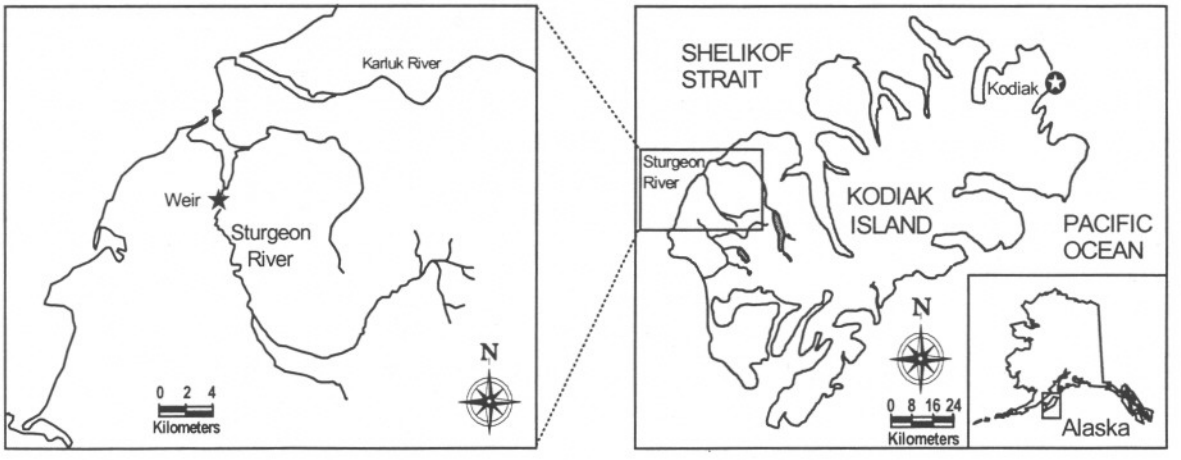

FIGURE 2.—Weir location in the Sturgeon River, Kodiak, Alaska, 1998-1999.

The Sturgeon River drainage is within the maritime zone with climatic conditions influenced by the warm Japanese current which flows along the Gulf of Alaska. Overall mean annual temperature is 4 °C. Average summer and winter temperatures are about 10 °C and -2 °C, respectively. Stream flow is characterized by peak flows during late May and early June in response to snowmelt. Rainstorms may produce secondary peaks in summer (U.S. Fish and Wildlife Service 1990).

The weir site is approximately 2.5 km upriver from the Sturgeon Lagoon. This section of the river is straight and unbraided. Average depth is approximately 0.5 m. Substrate at the weir site predominantly ranges from medium gravel (25-50 mm) to small cobble (75-150 mm).

Methods

Weir Operation and Physical Data

A flexible picket weir spanning 40 m was installed and operated from May 26 to July 24, 1999. The weir was patterned after a design used on the Alaska Peninsula (Nick Hetrick, U.S. Fish and Wildlife Service, personal communication). Weir pickets are schedule 40 polyvinyl chloride electrical conduit with a 2.5 cm inside diameter. The space between

individual pickets is 3.4 cm. Pickets are 1.5 m long and strung together with 3 mm aircraft cable to make panels 3 m long (Appendix 2). A spanning cable (6 mm aircraft) was strung bank to bank and pulled tight about 0.3 m above the surface of the water. The weir panels were leaned against the cable and supported with fenceposts and aluminum tripods (Appendix 3). This type of weir is not designed to incorporate a catwalk. Therefore, a 2.5 m freestanding steel tripod supporting a platform and seat for the fish observer was placed adjacent to the weir opening. A downstream migrant trap was used to sample steelhead.

The weir was inspected daily for holes and structural integrity. Fish carcasses and debris were cleaned from the weir as they accumulated.

A staff gauge was installed 100 m downstream of the weir to measure daily water levels. Water temperatures were collected between 0800 and 1000 hours.

Chum Salmon and Steelhead Counts

All fish were enumerated to species as they passed through counting chutes. Fish were passed and counted intermittently between 0800 and 2300 hours each day. The duration of counting sessions varied depending on the intensity of fish passage through the weir and were recorded to the nearest 0.25 hour.

The downstream migrant trap was checked a minimum of three times daily, and more frequently when fish were most actively moving downstream.

Results

Weir Operation and Physical Data

The weir was functional throughout the operational period. No holes were reported, water levels did not exceed the height of the weir, and no salmon were observed escaping through the pickets.

Stage heights ranged from 17 to 52 cm and averaged 28 cm (Appendix 4). Water temperatures ranged from 4 to 14 °C and averaged 9 °C (Appendix 4).

Chum Salmon and Steelhead Counts

During project operations, 71,610 chum salmon passed through the weir from May 28 to July 24. The run exhibited three pulses with the peaks occurring on June 14 (N=4,273), June 27 (N=3,582), and July 14 (N=5,320)(Figure 3). A total of 476 steelhead emigrated through the weir from May 26 to July 13, with the peak occurring on June 29 (N=86) (Figure 3). A summary of weir counts for 1998 and 1999 is shown in Appendix 5.

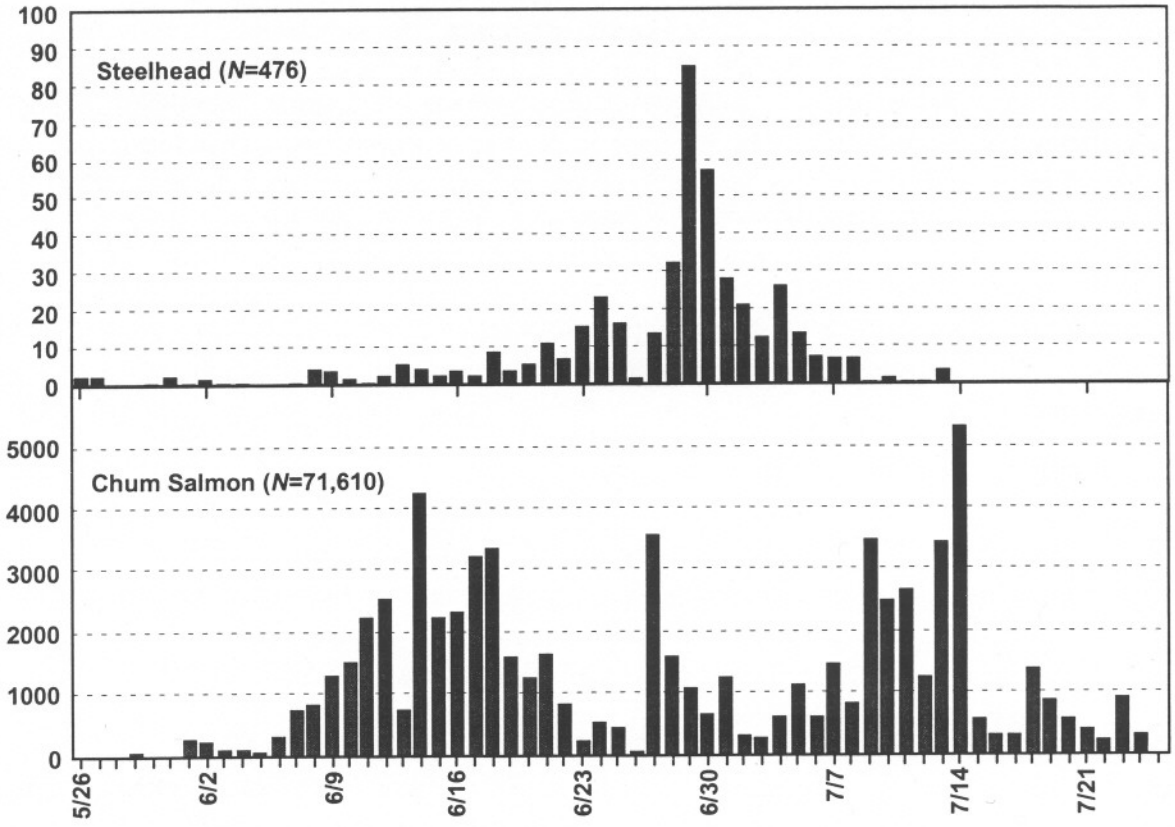

FIGURE 3.—Chum salmon and steelhead counts through the Sturgeon River weir, Kodiak, Alaska, 1999.

Discussion

The weir was an effective method for counting chum salmon returning to the Sturgeon River. This weir style was chosen for it's portability and cost effectiveness.

Average water velocities immediately upstream of the weir were 0.8 to 0.9 mps, and often reached 1.2 mps in the thalweg. The original design of this type of weir requires no tripods. This type of weir is relatively lightweight and easily transported to remote locations, but is not as robust as picket weirs supported by tripods, or resistance board weirs. Also, since this type of weir has no catwalk, water depth and velocity must be in a range where crew members can safely access and service the weir by wading. This year, four aluminum tripods were used to support the weir, which greatly enhanced it's stability.

The weir was installed on May 26 to enumerate steelhead outmigrants. Though chum salmon were not expected to enter the Sturgeon River until mid-June, they began to pass through the weir on May 28. It is unknown whether this was a unique event, or if it represents the early nature of this chum salmon run. In 1998, unusually high spring flooding prevented the weir from being installed until June 14. However, no chum salmon were observed staging in the lagoon and river prior to June 14, and few chum salmon passed through the weir until June 24. Therefore, it seems likely that chum salmon began entering the Sturgeon River in mid-June 1998.

Acknowledgments

Many people contributed to this project. Appreciation is extended to Cheryl Nugent and Holly Simpkins for their help with the hard work of setting up base camp and installing the weir; Clint Sestrich who also helped with set-up and who stayed on as a cheerful and able crew leader; and David Anderson who volunteered his time to staff the weir for two months.

Thanks to Tony Chatto in particular and the entire Kodiak National Wildlife Refuge staff in general for their generous support. Without their assistance, this project would not have happened.

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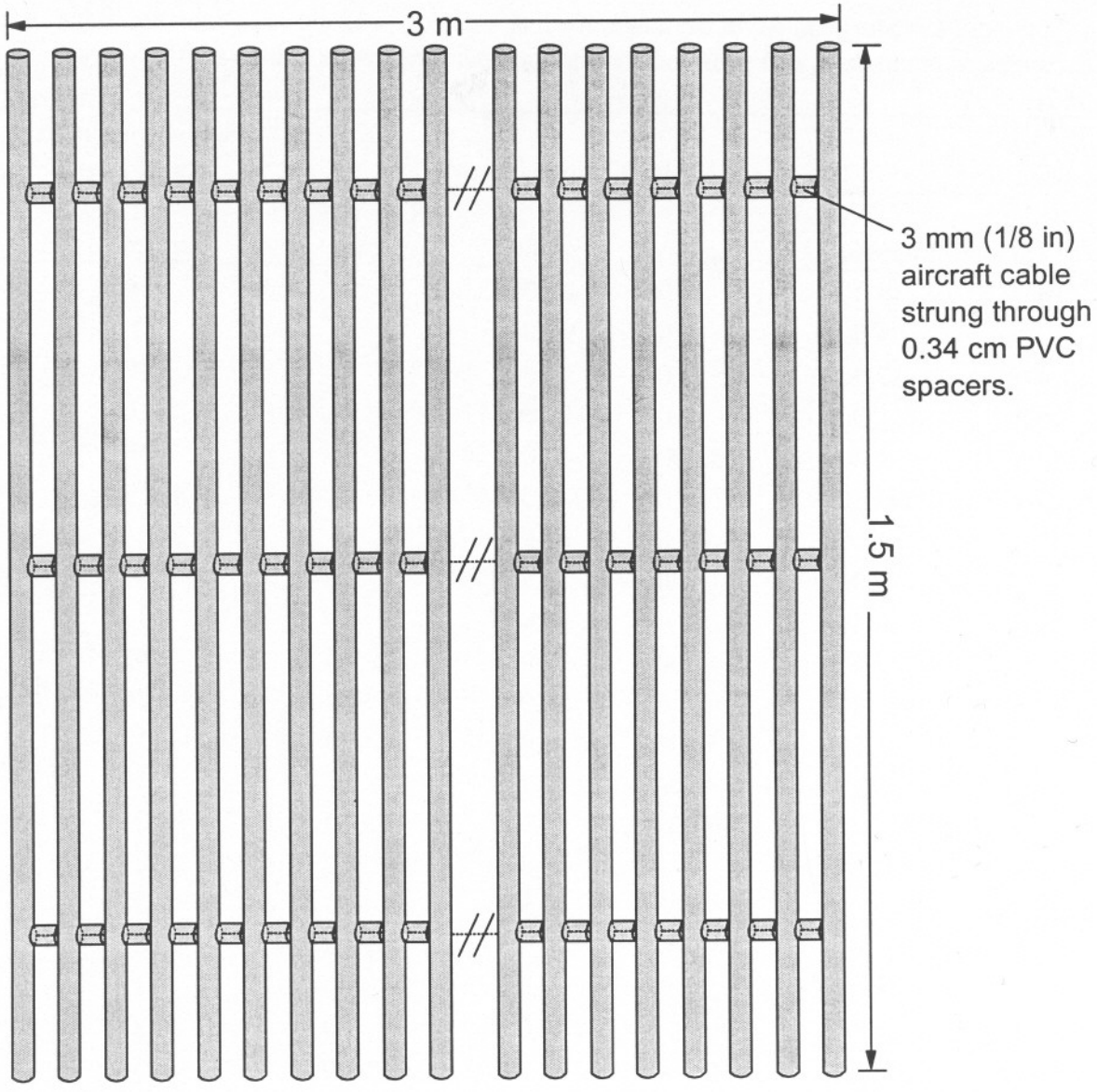
Appendix 1.—Sturgeon River drainage, Kodiak, Alaska, peak chum salmon aerial index escapement count data, and peak indexed brown bear streamside counts for the years 1976-1999.

	Peak Aerial Index Counts, Chum[a]				Peak Aerial Index Counts, Bear[b]
Year	In-stream	Lagoon	Total	Ten Yr. Average	Streamside
1976	45,000	0	45,000		16
1977	95,000	0	95,000		3
1978	57,000	0	57,000		19
1979	151,000	0	151,000		10
1980	9,000	35,000	44,000		19
1981	88,000	0	88,000		14
1982	85,000	0	85,000		31
1983	74,000	500	74,500		NS
1984	80,000	0	80,000		36
1985	15,000	4,000	19,000	73,850	42
1986	86,000	0	86,000	77,950	28
1987	1,000	15,000	16,000	70,050	17
1988	53,200	5,500	58,700	70,220	19
1989	5,000	30,000	35,000	58,620	21
1990	79,000	0	79,000	62,120	23
1991	22,500	25,000	47,500	58,070	38
1992	41,000	8,500	49,500	54,520	25
1993	1,300	12,500	13,800	48,450	11
1994	10,000	70,000	80,000	48,450	20
1995	23,000	9,200	32,200	49,770	36
1996	6,820	1,800	8,620	42,032	9
1997	3,600	5,500	9,100	41,342	2
1998	4,100	0	4,100	37,956	39
1999[c]	55,000	0	55,000	37,620	38

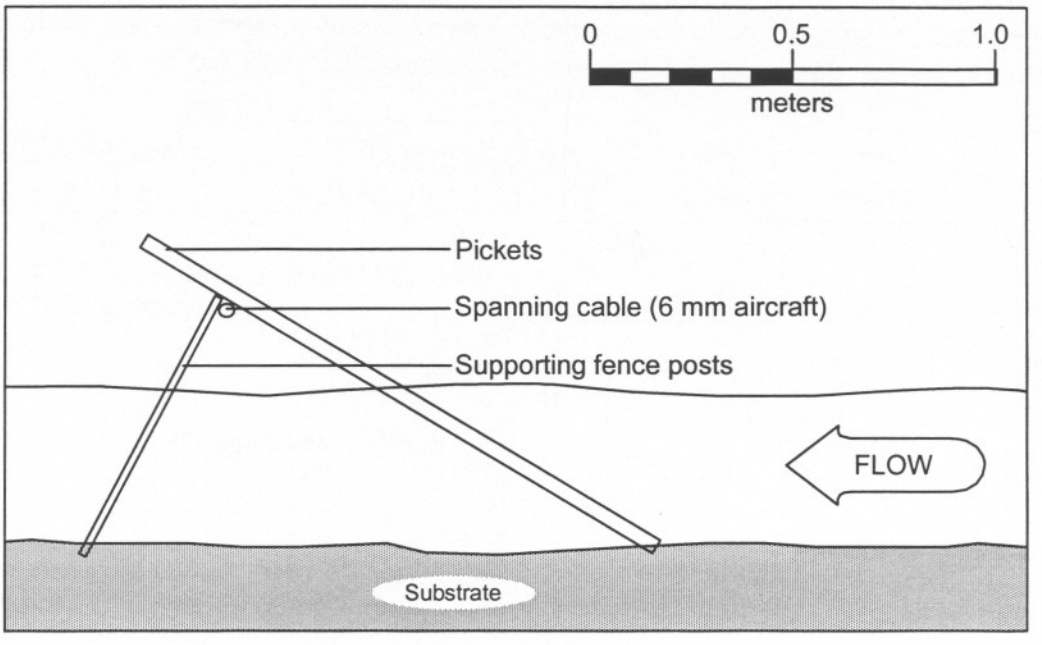
[a] *Data source: Alaska Department of Fish and Game, Kodiak Area Management files. Except for 1999 data, the estimates in the table are the single highest peak count, selected from a series of aerial surveys.*

[b] *Data source: U.S. Fish and Wildlife Service, Kodiak National Wildlife Refuge files.*

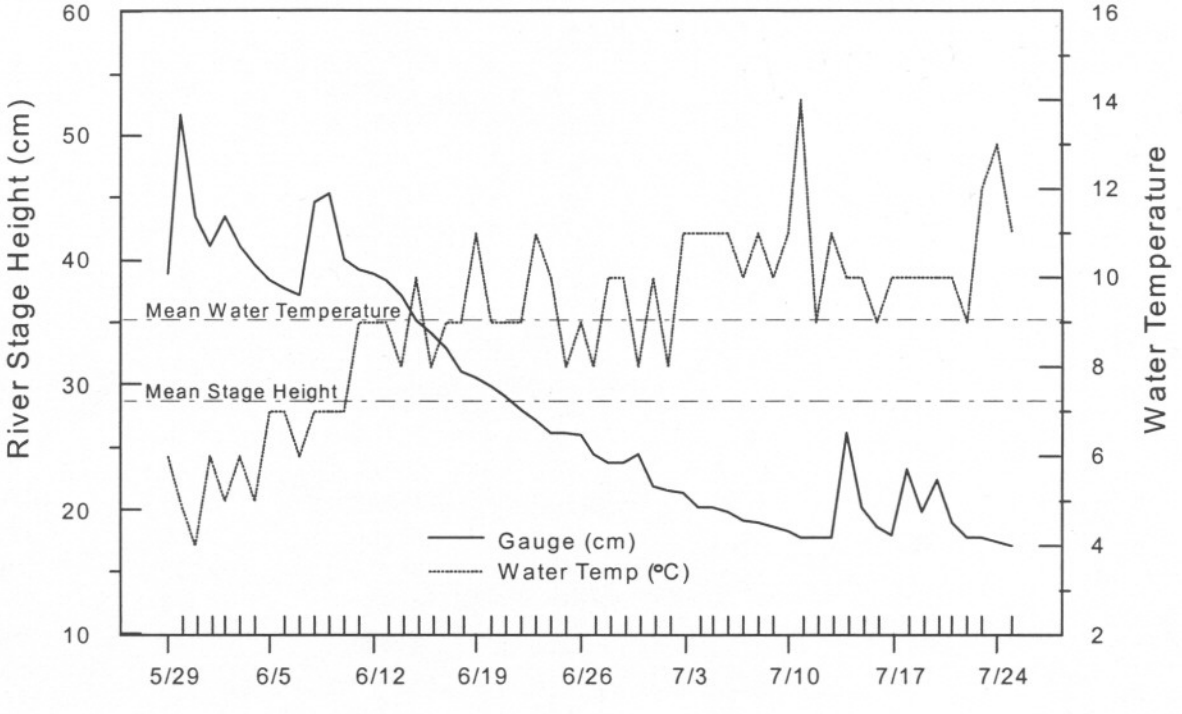
[c] *Estimate from 1999 is derived from in-stream fish only; lagoon counts are not part of the calculation. The 1999 estimate combines peak estimates from 6/23 and 7/21 because more than 15 days elapsed between surveys, and it is assumed that new spawners replaced the ones observed on the first survey.*



Appendix 2.—Weir panel with pickets constructed from schedule 40 polyvinyl chloride (PVC) electrical conduit with a 3.3 cm outside diameter and strung together with 3 mm aircraft cable.



Appendix 3.—Lateral view of an installed weir panel. Spanning cable is anchored to both banks and pulled tight so it does not sag into the water. Fence posts support the cable so the weight of the weir does not cause the panels to submerge.



Appendix 4.—River stage heights and water temperatures at the Sturgeon River weir, Kodiak, Alaska, 1999.

Appendix 5.—Daily and daily cumulative counts of salmon escapement and steelhead emigration through the Sturgeon River weir, Kodiak, Alaska, 1998 and 1999.

	Chum Salmon 1998		Chum Salmon 1999		Steelhead 1999	
Date	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative
5/26			0	0	3	3
5/27			0	0	3	6
5/28			3	3	0	6
5/29			49	52	0	6
5/30			28	80	1	7
5/31			31	111	3	10
6/1			258	369	1	11
6/2			222	591	2	13
6/3			101	692	1	14
6/4			110	802	1	15
6/5			84	886	0	15
6/6			334	1220	0	15
6/7			741	1961	1	16
6/8			823	2784	5	21
6/9			1310	4094	4	25
6/10			1530	5624	2	27
6/11			2258	7882	1	28
6/12			2556	10438	3	31
6/13			771	11209	6	37
6/14	0	0	4273	15482	5	42
6/15	5	5	2253	17735	3	45
6/16	47	52	2344	20079	4	49
6/17	76	128	3252	23331	3	52
6/18	6	134	3352	26683	9	61
6/19	23	157	1613	28296	4	65
6/20	66	223	1275	29571	6	71
6/21	100	323	1635	31206	12	83
6/22	48	371	830	32036	7	90
6/23	58	429	222	32258	16	106
6/24	1759	2188	547	32805	24	130
6/25	696	2884	469	33274	17	147
6/26	2517	5401	58	33332	2	149
6/27	715	6116	3582	36914	14	163
6/28	1026	7142	1597	38511	33	196
6/29	372	7514	1095	39606	86	282
6/30	171	7685	670	40276	58	340
7/1	672	8357	1276	41552	29	369
7/2	873	9230	311	41863	22	391
7/3	108	9338	263	42126	13	404
7/4	69	9407	641	42767	27	431
7/5	276	9683	1147	43914	14	445
7/6	355	10038	641	44555	8	453
7/7	1536	11574	1492	46047	7	460

Appendix 5.—(Continued).

	Chum Salmon 1998		Chum Salmon 1999		Steelhead 1999	
Date	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative
7/8	2695	14269	841	46888	7	467
7/9	3007	17276	3514	50402	1	468
7/10	5332	22608	2502	52904	2	470
7/11	63	22671	2678	55582	1	471
7/12	31	22702	1250	56832	1	472
7/13	42	22744	3454	60286	4	476
7/14	57	22801	5320	65606		
7/15	48	22849	586	66192		
7/16	18	22867	311	66503		
7/17	934	23801	319	66822		
7/18	205	24006	1404	68226		
7/19	51	24057	871	69097		
7/20	36	24093	593	69690		
7/21			398	70088		
7/22			248	70336		
7/23			936	71272		
7/24			338	71610		